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Delirium: An Independent Predictor of Functional Decline After Cardiac Surgery

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Abstract

Objective—While generally thought of as a transient cognitive disorder, delirium may have long-lasting functional consequences in older patients. The purpose of this study was to determine if patients who developed delirium after cardiac surgery were at increased risk of functional decline.

Design—Prospective cohort study

Setting—Two academic hospitals and a VA medical center

Participants—190 patients ≥60 years undergoing elective or urgent cardiac surgery.

Measurements—Delirium was assessed daily and was diagnosed according to the Confusion Assessment Method. Prior to surgery and postoperatively at 1-month and 12-months, patients were assessed for function using the Instrumental Activities of Daily Living (IADL) scale. Functional decline was defined as a decrease of one IADL at follow-up.

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Author Contributions: Drs Rudolph, Jones, and Marcantonio had full access to the data and take responsibility for the integrity of the data and accuracy of the analysis. Study concept and design: Drs. Rudolph, Inouye, Jones, Levkoff, and Marcantonio Acquisition of data: Drs Rudolph, Jones, Levkoff, and Marcantonio and Analysis and interpretation of data: Drs Rudolph, Inouye, Jones, Yang, Fong, Marcantonio. Drafting the manuscript: Drs Rudolph, Inouye, and Marcantonio. Critical revision of the manuscript: Drs Rudolph, Inouye, Jones, Yang, Fong, Levkoff, and Marcantonio. Funding and administrative support: Drs. Levkoff, Marcantonio, Rudolph, and Inouye

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Results—Delirium occurred in 43.2% (n=82) of the patients (mean age 73.7 ±6.7 years). Functional decline occurred in 36.3% (n=65/179) at 1-month and in 14.6% (n=26/178) at 12 months. Delirium was associated with increased risk of functional decline at 1-month (RR 1.9, 95% Confidence Interval (95%CI) 1.3, 2.8) and tended toward increased risk at 12 months (RR 1.9, 95%CI 0.9, 3.8). After adjustment for age, cognition, comorbidity, and baseline function; delirium remained significantly associated with functional decline at 1-month (adjusted RR 1.8, 95%CI 1.2, 2.6), but not at 12 months (adjusted RR 1.5, 95%CI 0.6, 3.3).

Conclusions—Delirium was independently associated with functional decline at 1-month and had a trend toward association at 12 months. Our findings lend justification for intervention trials to evaluate whether delirium prevention or treatment strategies might improve postoperative functional recovery.

Keywords

Delirium; function; cardiac surgery; aged; instrumental activities of daily living

Introduction

Delirium, an acute change in cognition and attention, is common after cardiac surgery with a reported incidence of 3-73%.¹ Postoperative delirium has been associated with early postoperative mortality^{2, 3}, prolonged length of stay, nursing home placement⁴, and increased healthcare costs.⁵ Delirium is traditionally thought of as a short-term cognitive disorder, but long-term consequences such as functional⁶ and cognitive decline⁷ are possible. The study of delirium and functional outcomes in cardiac surgery patients is critical because the large number of cardiac surgeries performed (>300,000 annually)⁸, the high incidence of postoperative delirium¹, and the impact of functional decline on a patient's quality of life.

Traditionally, studies evaluating outcomes from cardiac surgery have focused on cardiac stabilization and mortality. However, functional impairment after cardiac surgery is also critically important, particularly for clinicians who care for these patients longitudinally. In fact, since only select groups derive a survival benefit⁹, the predominant long-term goal of cardiac surgery is to preserve and improve function. Cardiac surgery is increasingly performed in the older age group⁸, in which improving function and quality of life are perhaps more pressing goals than prolonging life per se. Previous research examining functional and quality of life outcomes after cardiac surgery demonstrates that while most patients recover to or above their preoperative functional baseline, some do not.^{10, 11} The study of preventable factors that impair or delay functional recovery after cardiac surgery is critical because loss of independence is a major quality of life issue for patients, and is costly to the healthcare system and to society at large. In this setting, the impact of delirium, a potentially preventable condition that is common after cardiac surgery¹², on function has not been studied.

The purpose of this study was to determine if, at 1-month and 12-months after cardiac surgery: a) delirium was independently associated with functional decline, b) in those with independent functioning preoperatively, delirium was associated with functional decline, and c) delirium duration was associated with functional decline. We hypothesized that patients who develop delirium would be less likely to recover function at 1-month and 12-months following cardiac surgery. Because patients with baseline functional impairment may be more vulnerable to delirium and more likely to have functional decline, we further examined the influence of delirium in patients with intact (maximum) functional performance at baseline. We hypothesized that delirium in these high-functioning patients

would still be associated with functional decline. Finally, we hypothesized that those with delirium that lasted more than 1-2 days would be more likely to develop functional decline.

Methods

Subjects

From September 2002 until June 2006 we screened 1810 patients over age 60 years who were planning to undergo cardiac surgery at two academic medical centers and at one Veterans Administration (VA) hospital, as detailed in previous studies.¹² Exclusion criteria included insufficient time to consent and assess prior to surgery (n=401), living >60 miles from the medical center (n=373), surgeon request not to approach patients (n=181), medical instability that limited preoperative assessment time (n=177), planned aortic or carotid surgical procedures (n=109), inability to speak English (n=63) and other reasons (n=45)). Of the 461 patients approached, 200 refused to participate. After informed consent (n=261), the following (n=30) cohort losses occurred: surgery cancellation (n=9), additional ineligible surgical procedures such as carotid surgery (n=6), preoperative delirium (n=6), or withdrawal prior to the first postoperative delirium assessment (n=9). Thus, 231 patients were eligible for the initial cohort. Subsequently, patients who experienced a perioperative stroke (n=8) were excluded because stroke is associated with delirium and poor functional recovery¹³. Additionally, 33 patients were excluded from the analysis due to missing baseline functional assessment (n=6), withdrawal from the study after surgery (n=18), death before the 1-month follow-up (n=5), and loss to follow-up prior to 1-month appointment (n=5). Thus, 190 patients were included in the final cohort for the present study. There were no clinically or statistically significant differences between the excluded sample (n=33) and the final sample (n=190) in terms of age (75.4 ± 6.7 vs. 73.3 ± 6.6 years, respectively), Charlson Comorbidity Index (2.7 ± 1.9 vs. 2.3 ± 1.9), Mini-Mental State Examination (26.1 ± 2.6 vs. 27.0 ± 2.5), or Baseline Instrumental Activities of Daily Living (12.7 ± 1.5 vs. 12.9 ± 1.9), except with respect to delirium (67% vs. 43%, $p=.01$). The study was approved by the Institutional Review Board (IRB) at each institution.

Study Procedures

Preoperative Evaluation—After the decision for surgery was made, patients were approached about participation and all participants provided their written informed consent. Trained clinical interviewers carried out structured interviews with the patients prior to surgery using standardized instruments. The baseline patient interview included the Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs) for functional ability. IADLs are a scale of patient's ability to perform tasks necessary to live independently including driving, cooking, shopping, cleaning, telephone usage, and management of money and medications (range 0-14; 0-worst)¹⁴. Also at the baseline assessment, the Mini-Mental State Examination (MMSE) was performed to assess baseline cognitive functioning.¹⁵ The MMSE is a 30-point screening assessment of global cognitive function. Demographic and comorbidity information was recorded from the patient and supplemented with medical record review.

In-hospital postoperative assessment—Beginning on postoperative day 2, all patients were assessed for delirium daily until hospital discharge. The delirium assessment (<15 min) included the Mini-Mental State Examination (MMSE)¹⁵, digit span, the Delirium Symptom Interview (DSI)¹⁶, and the Memorial Delirium Assessment Scale (MDAS)¹⁷. The MMSE is a 30-point screening assessment of global cognitive function¹⁵ and was administered to all patients prior to surgery and at each delirium assessment thereafter. The digit span assessment is a test of working memory and attention, which asks patients to repeat a series of random digits forward and backward. The DSI is a validated interview

designed to elicit 8 key symptoms of delirium¹⁶. The MDAS is a validated 10-item severity scale for delirium which scores orientation, registration, and recall results from the MMSE; digit span results; and observational assessment of consciousness, sleep, and perceptual disturbances. Each of the MDAS 10 items is scored on a 0 (not present) to 3 (severe) scale (total range 0-30; 30-worst).¹⁷ Delirium was rated as present or absent using the validated algorithm of the Confusion Assessment Method (CAM)¹⁸ which has been shown to have high sensitivity (94%) and specificity (89%) against reference standard ratings of geriatric psychiatrists.¹⁹ The combined assessment for delirium used in the present study has been shown to be highly reliable ($\kappa=0.95$) when administered by trained interviewers.²⁰ In the event of a postoperatively intubated subject, we assessed delirium using the CAM-ICU, which uses a brief validated assessment to rate the CAM items in non-verbal patients.²¹ The daily assessment was augmented with medical record review for evidence of delirium features that may have occurred between interviews.

1-month and 12-month assessments—After surgery, patients were interviewed face-to-face in their homes and other locations (e.g. rehabilitation centers) to assess functional status using the ADLs and IADLs.

Delirium Assessment

Our major predictor variable was delirium, which was rated based on the cognitive assessment performed at baseline and daily throughout hospitalization. Delirium was diagnosed according to the CAM algorithm. We calculated the duration of delirium as the number of days between the initial positive delirium assessment (i.e., meeting full CAM criteria) and the final positive delirium assessment.

Functional Assessment

The primary outcome for this study was functioning based on the IADL scale¹⁴. IADLs were scored numerically with higher numbers representing better functioning (range 0-14; 0-worst). For this study, IADLs were examined both continuously and dichotomized. For the dichotomous outcome, each patient served as their own control and postoperative performance was subtracted from preoperative performance. Functional decline was defined as the loss of 2 IADL points, which correlates to the decline of 1 IADL or partial decline on 2 IADLs.⁴ IADLs have been previously shown to have high inter-rater reliability ($r=0.90-0.95$, $p<.0001$).²²

ADLs were also assessed for this study, but due to ceiling effects, nearly all patients were maximal levels at baseline and showed no significant decline. Thus, this measure was not sensitive to change and was not appropriate as an outcome for this study. Similarly, a combined IADL-ADL scale did not improve detection of change.

Other Study Variables

Patients provided information on demographics including age, sex, and marital status. Comorbidity information necessary to complete the Charlson Comorbidity Index²³ (range 0-34; 34-worst), a weighted sum of medical conditions with higher scores indicating more comorbidity, was collected from the medical record and supplemented with information from patient interview. Baseline cognitive function was assessed with the MMSE.

Operative Procedure

All subjects underwent cardiac surgery (CABG, valve, or combined CABG-valve) under general anesthesia. The anesthesia protocol and operative procedure were performed in accordance with local hospital policies and protocols. The use of cardiopulmonary bypass,

aortic cross clamp, high-dose heparin, and hypothermia was at the discretion of the attending surgeon. Postoperative care, including pain control, was administered in accordance with the policies and practices at each hospital. From the operative report, we recorded the surgical procedure, operative time, and use of cardiopulmonary bypass. We recorded perioperative stroke from the medical record.

Statistical Analyses

For each baseline characteristic, patients who did and did not develop delirium were compared using the appropriate test statistics, including Student's t-test for continuous variables and the chi-square test for dichotomous and ordinal variables. The distribution of the IADL outcome was examined. Because IADL responses were distributed in a non-parametric pattern, we compared baseline IADL using a Wilcoxon rank sum. Variables with $p < 0.10$ in bivariable analyses were used as continuous variables subsequent multivariable analyses. All statistical analyses were performed using STATA version 9.1 (STATA, Inc., College Station, TX).

Functional Performance – Continuous Outcome—To analyze change from baseline, we compared the mean IADL between those with and without delirium at 1-month or 12-month performance using a Student's t-test. For adjusted analyses, we performed multivariable linear regression models to estimate adjusted mean values for 1-month and 12-month IADL function. As above, adjustment variables were identified in bivariable analyses and used as continuous variables.

Functional Decline – Dichotomous Outcome—We examined the unadjusted risk of functional decline (≥ 2 IADL points) with delirium using the chi-square test. The adjusted analyses used a multivariable Poisson regression, adjusting for covariates which tended to be different ($p < .10$) between groups at baseline. Given the non-normal distribution of our IADL data, the Poisson regression was chosen since it makes no assumptions about the underlying distribution of the data and yields a risk ratio.

Functional Decline in Patients with Full Independent Functioning at Baseline—Because baseline functional performance may be an important confounder influencing both risk of delirium and of functional decline, we performed a subgroup analysis of functional decline in patients with independent function (IADL=14) at baseline. The unadjusted risk of functional decline with delirium was examined with the chi-square test. The adjusted risk was examined using a multivariable Poisson regression, adjusting for covariates which tended to be different ($p < .10$) between groups at baseline. Baseline function was not included as a covariate in the regression, because all patients in this subgroup had an IADL score of 14.

Duration and Severity of Delirium—To examine the relationship of the duration and severity of delirium to the risk of functional decline, we used a bivariable Poisson regression for the unadjusted analyses. For the adjusted analyses, we used a multivariable Poisson regression, controlling for age, comorbidity, MMSE and baseline IADL score.

Results

Delirium occurred in 43% ($n=190$) of the final cohort. The characteristics of those who developed delirium and those who did not are presented in Table 1. Participants who developed delirium were significantly older (75.1 ± 6.3 vs. 72.0 ± 6.5 years, $p < .01$), had higher Charlson Comorbidity Index (2.7 ± 2.2 vs. 1.9 ± 1.6 , $p = .01$), and lower preoperative MMSE scores (26.2 ± 2.8 vs. 27.2 ± 2.1 , $p < .01$). Patients who developed delirium had

significantly lower IADL function at baseline (12.2 ± 2.2 vs. 13.2 ± 1.5 , $p=.03$). Delirium lasted for a median of 1 day (75% interquartile range 1, 3 days) and the mean peak MDAS score was 10.3 (± 3.4), suggesting that most cases of delirium were relatively short and mild.

At the 1-month assessment, 11 patients from the analysis cohort declined the interview, but completed the 12-month assessment. At the 12-month assessment, 12 patients from the analysis cohort did not complete the interview (5 withdrew, 4 died, and 3 declined). Table 2 presents the unadjusted and adjusted functional correlates of delirium at 1 and 12-months. IADL score was significantly decreased in those with delirium at 1 and 12-months. The adjusted model estimate for IADL was significantly lower in those with delirium at 1-month, but not at 12-months.

Table 3 describes the risk of functional decline (≥ 2 IADL points) with delirium. At the 1-month assessment, the relative risk for IADL decline with delirium was 1.9 (95%CI 1.3, 2.8) compared to those without delirium. After adjustment for age, comorbidity, and cognition, the relative risk of IADL decline with delirium was 1.8 (95%CI 1.2, 2.6). At 12-months, the unadjusted relative risk for IADL decline with delirium (RR 1.9, 95%CI 0.9, 3.8), which was similar in magnitude to the 1-month decline, but not statistically significant. The adjusted relative risk was not statistically significant at 12-months (adjusted RR 1.5, 95%CI 0.6, 2.2). For the 1-month analysis, the calculated power ($1-\beta$) for detection of functional decline was 0.85 for the sample studied. However, for the twelve month analysis, the calculated power was 0.37 for detection of functional decline, and a sample of 461 patients would have been required to achieve a power of 0.80.

In patients with intact independent functioning at baseline ($n=97$), delirium was associated with functional decline at 1-month (adjusted RR 1.7, 95%CI 1.1, 2.7), but not at 12-months (adjusted RR 1.6 95%CI 0.6, 4.0) after adjustment for age, comorbidity, and cognition (Table 4).

The duration of delirium (Table 5) significantly increased the risk of 1-month functional decline (RR 1.7 95%CI 1.3, 2.1). After adjustment for age, comorbidity, cognition and baseline function, each additional day of delirium increased the risk of functional decline (adjusted RR 1.6, 95%CI 1.2, 2.0). The duration of delirium was not associated with 12-month functional decline. Increasing delirium severity measured by the MDAS was associated with an increased risk of functional decline at 1-month (RR 1.1 per 1 point MDAS increase, 95%CI 1.02, 1.1), but not 12 months (RR 1.05, 0.9, 1.1).

Discussion

In this prospective study, we examined function in patients with and without delirium after cardiac surgery. Delirium was significantly associated with risk of functional decline, measured by the IADLs, at 1-month, independent of age, comorbidity, baseline function, and cognition. At 12-months, the relative risk of functional decline given delirium was similar in magnitude, but did not achieve statistical significance, likely due to inadequate power. Even after removing the confounding influence of baseline functional impairment, patients with independent IADL function at baseline who developed delirium were still at increased risk of functional decline at 1-month. Additionally, the duration of delirium significantly increased the risk for functional decline at 1-month. Our data demonstrate that delirium after cardiac surgery is more than an acute, in-hospital problem; even short-lived, mild delirium can have functional consequences that persist long after hospital discharge.

There are important clinical implications to our finding that a short episode of postoperative delirium can impact function at 1-month, and possibly 12-months postoperatively. First, assessment of preoperative delirium risk with a validated delirium prediction rule¹² is

crucial to stratify the patient's risk of delirium and to adequately inform patients and caregivers about this risk and its potential complications. Second, assessment of preoperative function becomes more important to facilitate detection of postoperative decline. Third, the postoperative surveillance for delirium is crucial to detect it early, address its reversible causes, and implement needed rehabilitation services early to reduce the risk of associated functional decline. Finally, functional status should be monitored for one year after cardiac surgery and families must be informed that the recovery of functional status may be a prolonged process.

The study expands the literature concerning functional outcomes after cardiac surgery. First, prior work in cardiac surgery has largely focused on long-term cognition^{24, 25} or function^{10, 11}. Our current analysis demonstrates that delirium, a short term postoperative complication, can impact these long term outcomes and highlights the importance of this clinically relevant and potentially preventable condition. Second, the existing literature examining the associations between postoperative delirium and long-term function, mostly in the non-cardiac surgery population, has been inconsistent with some studies finding an association^{4, 26} and others not.^{27, 28} Our current analysis provides additional evidence supporting such an association, and demonstrates the importance of using adequately sensitive functional measures to track outcomes. Basic functional measures, such as the Activities of Daily Living (ADLs) are appropriate when the population is functionally impaired at baseline, such as in patients with hip fracture.⁴ As demonstrated in our current study of cardiac surgery patients, when baseline function is generally preserved, ADLs may be sub-optimal for functional assessment because of ceiling effects. In these populations, measures of independent functioning, such as IADLs, which are higher-level activities requiring intact cognition, are more sensitive to change. Finally, by describing the inter-relationship between delirium and functioning, this study recognizes the importance of cognition in recovery of independent functioning and highlights the need for intervention trials to identify strategies to prevent delirium after cardiac surgery to preserve function.

The strengths of this study include the older age of the cohort, the state-of-the-art delirium assessment methods, and the completeness of follow-up. Since age has been shown to be a risk factor for functional impairment, our recruitment of an older cohort with a mean age of 74 years is particularly clinically relevant. The state-of-the-art delirium assessment methods, supplemented by detailed medical record review, ensured near-complete capture of episodes of delirium. Finally, the our completion of postoperative assessments of function in 82% of the initial cohort and 94% of the analysis cohort was equivalent or superior to previous studies of postoperative patients.^{24, 27, 29} The cohort losses from the initial cohort (n=33) demonstrated higher delirium rates than the final cohort (n=190) which likely biased our results toward the null, and contributed to the lack of statistical significance at 12-months. Thus, the finding of significant associations between delirium and functional decline may be more robust when replicated in a different cohort.

Several limitations in our study deserve comment. The sensitivity of our functional measures to change may have been limited. The IADLs demonstrated a skewed distribution, which would also bias our results toward the null because of a potential ceiling effect. More sensitive measures of functional capacity at baseline might allow detection of a wider range of change after cardiac surgery. To help interpretation and improve clinical utility, we presented our data using both continuous and dichotomous outcomes. While our continuous measure of IADL function demonstrated a significant difference between the delirious and non-delirious group at 1 year, the unadjusted dichotomous relative risk was not significant. The conversion of continuous measures, such as IADLs to dichotomous ones improves clinical utility of our findings, but potentially reduces statistical power. Additionally, further work is needed to further investigate the association of delirium with functional decline,

particularly at time points between 1-month and 12-months. Finally, the relationship between IADL and postoperative cognitive function is not fully elucidated and remains an area for further investigation.

This prospective study found that delirium was independently associated with functional decline 1-month after cardiac surgery. The association of delirium with functional decline was of similar magnitude at 12-months, but not statistically significant; likely due to limited power. Even among patients with preoperative independent functioning, delirium increased the risk of functional decline 1-month after cardiac surgery. Because the functional consequences of delirium may persist long after the acute episode of delirium, risk stratification, prevention, and surveillance for delirium¹² are critical in older patients undergoing cardiac surgery. Moreover, these results suggest that future intervention trials are greatly needed to evaluate whether delirium prevention and/or treatment can decrease the observed rates of post-hospital functional decline. Thus, this study is highly clinically relevant, and presents a timely area for future investigation.

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Table 1

Baseline characteristics of those with and without delirium

Characteristic	No Delirium Mean(\pm SD) n (%) (n=108)	Delirium Mean(\pm SD) n (%) (n=82)	p-value* No Delirium vs. delirium
Baseline			
Age	72.0(\pm 6.5)	75.1(\pm 6.3)	<.001
Sex, Female	19 (18%)	21(26%)	.18
Married	75(70%)	51(62%)	.30
Charlson Comorbidity Index	1.9(\pm 1.6)	2.7(\pm 2.2)	.01
Mini-Mental State Examination	27.7(\pm 2.1)	26.2(\pm 2.8)	<.001
Activities of Daily Living (ADL, range 0-12, 12 best) [†]	11.9(\pm 0.4)	11.9(\pm 0.5)	.76
Instrumental Activities of Daily Living (IADL, range 0-14, 14 best) [†]	13.2(\pm 1.5)	12.5(\pm 2.2)	.03
Operative			
Urgent Surgery	75(69%)	62(76%)	.35
Valve surgery (+/- CABG)	20(19%)	21(26%)	.24
Surgical Time, Minutes	230(\pm 69)	240(\pm 67)	.31
Cardiopulmonary bypass	105(97%)	78(95%)	.45

SD – standard deviation

* Those without delirium (n=108) are compared to those with delirium (n=82) using a Student's t-test for continuous variables and a chi-square test for dichotomous variables

[†] Because of nonparametric distribution, ADL and IADL were compared using a Wilcoxon rank sum test

Table 2

Delirium and IADL Function at 1 and 12-months after Cardiac Surgery

Instrumental Activities of Daily Living (IADL) Score*	Unadjusted		Adjusted†		p-value
	No Delirium mean(±SD)	Delirium mean(±SD)	No Delirium mean(±SD)	Delirium Mean(±SD)	
1-month IADL Score*	12.1 (±1.9)	10.6 (±2.9)	11.8 (±3.0)	11.0 (±3.6)	.02
12-month IADL Score*	12.8 (±2.3)	12.0 (±2.4)	12.6 (±3.1)	12.4 (±3.6)	.50

IADL - Instrumental Activities of Daily Living (range 0-14, 14 best); SD – standard deviation

* Compares IADL score in those with and without delirium

† Adjusted analyses use linear regression models to predict IADL score after adjustment for age, Charlson Comorbidity Index, Mini Mental State Examination and baseline IADL scores.

Table 3

Delirium and Risk of Functional Decline

	Rate of Functional Decline [*]		Risk of Functional Decline [†]	
	With delirium n/N (%)	Without delirium n/N (%)	Unadjusted Risk Ratio (95% CI)	Adjusted Risk Ratio [‡] (95% CI)
<u>1-month</u>				
1-month functional decline [*]	37/74 (50%)	28/105 (27%)	1.9 (1.3, 2.8)	1.8 (1.2, 2.6)
<u>12-month</u>				
1-month functional decline [*]	16/78 (21%)	11/100 (11%)	1.9 (0.9, 3.8)	1.5 (0.6, 3.3)

CI – Confidence Interval

^{*} Functional decline is defined as a decline of ≥ 2 Instrumental Activities of Daily Living (IADL) points at the follow up assessment relative to the preoperative assessment

[†] Risk of functional decline in those with delirium relative to those without delirium

[‡] Adjusted analyses use Poisson regression to adjust for age, Charlson Comorbidity Index, Mini Mental State Examination, and baseline IADL scores

Table 4

Risk of Functional Decline in Patients with Independent Function at Baseline (n=97)

Time	Functional Decline		Risk of Functional Decline [*] (95% CI)	Adjusted Risk of Functional Decline [†] (95% CI)
	With delirium n/N (%)	Without delirium n/N (%)		
1-month	21/33 (64%)	21/64 (33%)	1.9 (1.3, 3.0)	1.7 (1.1, 2.7)
12-month	8/33 (24%)	8/59 (14%)	1.8 (0.7, 4.3)	1.6 (0.6, 4.0)

CI – Confidence Interval

^{*} Risk of functional decline in those with delirium relative to those without delirium[†] Adjusted analyses use Poisson regression to adjust for age, Charlson Comorbidity Index, and Mini Mental State Examination scores. Baseline Instrumental Activities of Daily Living (IADL) score was not included as an adjustment variable, because the subgroup all had independent IADL performance (IADL score =14) at baseline.

Table 5

Duration of Delirium and Functional Decline

	Delirium Duration	Functional Decline % (n/N)	p-value*	Unadjusted RR [†] (95% CI)	Adjusted RR [‡] (95% CI)
1-month					
	No Delirium	26% (28/106)			
	1-2 Days	42% (23/55)			
	≥3 days	74% (14/19)	<.001	1.7 (1.3, 2.1)	1.6 (1.2, 2.0)
12-month					
	No Delirium	11% (11/100)			
	1-2 Days	24% (13/55)	0.11	1.3 (0.9, 1.9)	1.1 (0.7, 1.8)
	≥3 days	13% (3/23)			

CI – Confidence Interval

* p-value calculated with a chi-square test

† Risk of functional decline by duration calculated with a bivariable Poisson regression

‡ Risk of functional decline by duration after adjustment for age, comorbidity, cognition and baseline IADL score.